REMARKS

The present application was filed on November 26, 2003 with claims 1-29.

In the outstanding Office Action dated December 29, 2006, the Examiner: (i) objected to claims 9 and 23; (ii) rejected claims 1-7, 9, 15-21, 23 and 29 under 35 U.S.C. §103(a) as being obvious over an article by Bar-Noy et al. article entitled "On Chromatic Sums and Distributed Resource Allocation," (hereinafter "Bar-Noy"); (iii) rejected claims 10, 12, 13, 24, 26 and 27 under 35 U.S.C. §103(a) as being unpatentable over Bar-Noy in view of an article by Shih et al. entitled "An Approximation Algorithm for Coloring Circular-Arc Graphs," (hereinafter "Shih"); and (iv) rejected claims 14 and 28 under 35 U.S.C. §103(a) as being unpatentable over Bar-Noy in view of an article by Ramaswami et al. entitled "Routing Wavelength Assignment in All-Optical Networks," (hereinafter "Ramaswami").

Claims 8, 11, 22 and 25, which are indicated as containing allowable subject matter, have been rewritten in independent form.

In this response, Applicants respectfully traverse the objection and the §103(a) rejections to the claims. Applicants respectfully request reconsideration of the present application in view of the remarks below.

With regard to the Examiner's objection to the term "polynomially," Applicants respectfully point out that "polynomially" is a term of art commonly used in Computer Science. There are a number of published papers that recite the term. For example, the paper entitled, "A Class of Polynomially Solvable Range Constraints for Interval Analysis without Widenings," by Zhendong Su and David Wagner, which was published in the Theoretical Computer Science, Volume 345, Issue 1 (November 2005), recites the term "polynomially" in the title of the paper.

Accordingly, Applicants respectfully request the objection to the term "polynomially" to be withdrawn.

Regarding the §103(a) rejection of claims 1-7, 9, 15-21, 23 and 29, Applicants respectfully traverse on the ground that the Bar-Noy reference fails to teach or suggest all the claim limitations.

Independent claim 1 is directed to a method of designing a line system, the method comprising the steps of: obtaining a set of one or more demands for use in computing the line system

design; and representing the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost.

The relied-upon portions of Bar-Noy do not meet certain limitations of claim 1, as alleged. As explained in the Bar-Noy abstract, the coloring algorithm of Bar-Noy deals only with "a conflict graph that represents the competition of processors over resources, [they] seek an allocation under which no two jobs with conflicting requirements are executed simultaneously." That is, the goal of Bar-Noy is to minimize conflicts caused by simultaneous processor job executions.

The Examiner points to page 5, "Applications," first paragraph of Bar-Noy as disclosing the limitation "obtaining a set of one or more demands for use in computing the line system design," as recited in claim 1. As noted in the present specification (with emphasis supplied), "the term 'demand' generally refers to a <u>bandwidth request between nodes</u>. For example, a demand may be made for a wavelength between OADM 106-2 and end terminal 102-2 in FIG. 1." (See the present specification at page 3, lines 24-26). The relied-upon portion of Bar-Noy states the following:

> Our main application is the problem of resource allocation with constraints imposed by *conflicting resource requirements*. In a common representation of the distributed resource allocation problem [11, 26], the constraints are given by a conflict graph *G*, in which the nodes represent processors, and the edges indicate competition on resources, i.e., two nodes are adjacent if the corresponding processors cannot run their jobs simultaneously. We focus on the *one shot* resource allocation problem [31, 4], in which we have to allocate resources to one batch of requests.

In contrast, the Bar-Noy reference discloses of requests for resources, i.e., processors to run jobs, not a set of one or more demands for use in computing the line system design, as recited in claim 1.

In characterizing the Bar-Noy reference as teaching or suggesting the limitation of "representing the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost," the Examiner relies on page 5, Chromatic Sums of Graphs, and page 19, section 5 of Bar-Noy. No where in the relied-upon portions of Bar-Noy does Bar-Noy disclose "colors representing bandwidth such that bandwidths are

assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost," as claimed. The Examiner acknowledges that "Bar-Noy does not disclose expressly the colors representing bandwidths" on page 3, paragraph 4 of the present office action. However, Bar-Noy also does not implicitly teach or suggest colors representing bandwidths such that bandwidths are assigned. The Examiner points to page 19, section 5, paragraph 2 of Bar-Noy as teaching or suggesting the limitation of achieving a minimum total design cost. Page 19, section 5, paragraph 2 of Bar-Noy states the following:

> Any scheduler needs to satisfy the properties of safety and liveness mentioned above. The total time that elapses from a processor's request for resources until it can execute its job is regarded as the *response time* for that processor. We seek solutions for the problem that minimize the average response time of the system.

Page 20, first paragraph states the following:

> We show that every sequential algorithm which finds the optimal schedule, can be used to find in polynomial time the chromatic sum of a graph. Given a graph G, an integer k and the question 'Is MCS(G) < k?', construct a conflict graph C=G and apply the optimal scheduling algorithm on a slow execution of the one-shot resource allocation problem.

Thus, Bar-Noy teaches of finding an optimal schedule so that the goal of minimizing conflicts caused by simultaneous processor executions is achieved. In contrast, the claimed invention recites "representing the line system design as a graph in accordance with a graph coloring operation wherein colors represent bandwidths such that bandwidths are assigned and the one or more demands are routed so as to attempt to achieve a minimum total design cost." Thus, there is absolutely no suggestion in Bar-Noy to modify Bar-Noy to have colors represent bandwidths such that bandwidths are assigned. The fact that Bar-Noy uses the term "resource allocation" does not support a suggestion that such a resource includes bandwidth.

For at least these reasons, Applicants assert that claim 1 is patentable over Bar-Noy.

Independent claims 15 and 29 include limitations similar to those of claim 1, and are therefore believed allowable for reasons similar to those described above with reference to claim 1.

Regarding the claims that depend from independent claims 1 and 15, Applicants assert that

such claims are patentable not only due to their respective dependence on claims 1 and 15, but also because such claims recite patentable subject matter in their own right. Also, neither Shih nor Ramaswami remedy the deficiencies described above with regard to Bar-Noy.

With regard to claims 2 and 16, the Examiner relies on page 8, section 2.1, paragraph 2 of Bar-Noy as disclosing the limitation, "colors are partitioned in sets and the sets are ordered so that colors in higher sets cost more than colors in lower sets." Bar-Noy on page 8, section 2.1 paragraph 2 states the following:

> An *independent set (IS)* in G is a subset V' of V such that every vertex in V' has no neighbor in V'. A *maximal independent set* is an IS which is not contained in a strictly larger IS, and a *maximum independent set (MaxIS)* is an IS of maximum size in G. A *c-coloring* of G is a partition of V into c independent sets. A c-coloring is specified by a mapping Ψ: $V \rightarrow \{1,\ldots,c\}$. The IS that consists of vertices with $\Psi(v)=I$, is denoted by C_i. The *chromatic number* of a graph, denoted by $X(G)$ is the smallest possible c for which there exists a c-coloring of G. A *c-edge-coloring* of G is a partition of E into c sets, such that no two edge in the same set share an endpoint. The *chromatic index* of a graph, denoted by $I(G)$ is the smallest possible c for which there exists a c-edge-coloring of G.
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No where in the relied-upon portions of Bar-Noy does Bar-Noy teach or suggest of partitioning colors in sets and ordering the sets so that colors in higher sets cost more than colors in lower sets.

With regard to claims 3 and 17, the Examiner points to page 5, Applications, first paragraph of Bar-Noy as disclosing "a link of the graph represents a location of a component of the line system being designed." The Examiner refers to the recited "node" in Bar-Noy as teaching or suggesting of the "link" in claims 3 and 17. However, Bar-Noy, with regard to nodes, states that "two nodes are adjacent if the corresponding processors cannot run their jobs simultaneously," and does not teach or suggest of a "node" representing a location of a component of the line system being designed, as recited in claims 3 and 17.

With regard to claims 4 and 18, the Examiner refers to page 16, section 4, first paragraph of Bar-Noy as disclosing the limitation of "the cost of a link in a coloring is equal to the cost of the most expensive set such that a demand going through the link is colored with a color in the most expensive set." The relied-upon portion of Bar-Noy discloses of a maximal independent set, but

does not teach or suggest of the maximal independent set being the most expensive set, or the cost of a link in a coloring being equal to the maximal independent set, such that a demand going through a link is colored in the most expensive set.

With regard to claims 5 and 19, the Examiner points to page 5, Applications, Mutual exclusion of Bar-Noy as disclosing the limitation "wherein colors are assigned to the demands such that no two demands routed on the same link of the graph are assigned the same color." Bar-Noy states the following with regard to mutual exclusion: "No two conflicting jobs are executed simultaneously." As noted above in reference to claim 1, a demand refers to a bandwidth request between nodes, not to a request to process a job. Furthermore, Bar-Noy does not refer to mutual exclusion of "colors".

In view of the above, Applicants believe that claims 1-29 are in condition for allowance, and respectfully request withdrawal of the various objections and §103(a) rejections to the claims.

Respectfully submitted,

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